Claims

We claim

1. An apparatus for producing a signal representing rotational speed, comprising:

a target component supported for rotation;

a second component having a portion thereof at least partially overlapping the target component, said portion being formed of material having a relative magnetic permeability equal to or less than 25.0; and

a sensor including a coil and a magnet generating a flux path extending through said portion of the second component to said target component, the flux path having a reluctance that varies with rotation of the target component, the coil carrying a signal generated in response to changes in said reluctance, the signal having a frequency representing the rotational speed of the target component.

2. The apparatus of claim 1, wherein the signal has a predetermined amplitude, and said portion is made of material that has substantially no effect on the amplitude of said signal.

3. The apparatus of claim 1 wherein the signal has a predetermined amplitude, and said portion is made of material that has substantially no effect on magnitude of the reluctance of the flux path.

4. The apparatus of claim 1, wherein the material of the second component has a concentration of martensite that is less than thirty percent.

5. The apparatus of claim 1, wherein material of said portion is a member of the group consisting of aluminum, titanium and stainless steel.

6. The apparatus of claim 1, wherein the target component includes an outer surface facing the sensor and having a plurality of mutually spaced surface variations on the outer surface.

7. The apparatus of claim 6, wherein said surface variations are radially extending teeth, each tooth spaced angularly from an adjacent tooth by a land, the distance between adjacent teeth being uniform and substantially equal.

8. The apparatus of claim 1 wherein the magnet generates a magnetic field, and the sensor further comprises a ferritic core, and the coil is wound around the core.

9. The apparatus of claim 1 wherein said portion the second component is stainless steel formed by stamping at a temperature greater than 32 degrees F.

10. The apparatus of claim 1 wherein said portion of the second component is of stainless steel having an instability factor that is less than 2.9 percent, and is formed by stamping at a temperature greater than 32 degrees F.

11. The apparatus of claim 1 wherein said portion of the second component is of stainless steel having a concentration of martensite that is less than 15 percent, and is formed by stamping at a temperature greater than 50 degrees F.

12. The apparatus of claim 1 wherein said portion of the second component is formed of stainless steel having an instability factor that is less than 1.0 percent, and is formed by stamping at a temperature greater than 50 degrees F.

13. An apparatus for producing a signal indicating rotational speed, comprising:

a target component mounted for rotation;

a second component having a portion thereof at least partially overlapping the target component; and

a sensor including a coil and a magnet generating a flux path extending through said portion of the second component to

said target component, the flux path having a magnetic reluctance that varies with rotation of the target component, the coil carrying a signal generated in response to changes in said reluctance, the signal having a predetermined pear-to-peak amplitude and a frequency indicative of the rotational speed of the target component.

14. The apparatus of claim 13 wherein the material of said portion has substantially no effect on the amplitude of said signal.

15. The apparatus of claim 13 wherein the material of said portion has substantially no effect on magnetic reluctance of the flux path between the sensor and target component.

16. A system for determining a rotational speed of a target component, the system comprising:

a second component having at least a portion surrounding the target component, said portion being formed of material having a relative magnetic permeability equal to or less than 25.0; and

a magnetic source generating a magnetic flux path within which the target component and second component are located, rotation of the target component causing changes in a characteristic of the magnetic flux path;

a detector generating a position signal that varies in response to changes in said characteristic; and

a controller for determining a rotational speed of the target component based on values of said position signal over time.

17. A power transmission, comprising:

a case substantially fixed against rotation and enclosing transmission components;

a target component located in the case and supported for rotation;

a second component located in the case, having a portion thereof at least partially surrounding the target component, said portion

being of material having a relative magnetic permeability equal to or less than 25.0; and

a sensor mounted on the case near the target component and second component, said portion of the second component being located between the sensor and target, including a coil and a magnet generating a flux path extending through said portion of the second component to said target component, the flux path having a reluctance that varies with rotation of the target component, the coil carrying a signal generated in response to changes in said reluctance, the signal having a frequency indicative of the rotational speed of the target component.

18. The apparatus of claim 17, wherein the signal has a predetermined amplitude, and said portion is made of material that has substantially no effect on the amplitude of said signal.

19. The apparatus of claim 17 wherein the signal has a predetermined amplitude, and said portion is made of material that has substantially no effect on magnitude of the reluctance of the flux path.

20. The apparatus of claim 17, wherein the material of the second component has a concentration of martensite that is less than thirty percent.

21. The apparatus of claim 17, wherein material of said portion is a member of the group consisting of aluminum, titanium and stainless steel.

22. The apparatus of claim 17, wherein the target component includes an outer surface facing the sensor and having a plurality of mutually spaced surface variations on the outer surface.

23. The apparatus of claim 22, wherein said surface variations are radially extending teeth, each tooth spaced angularly from an adjacent tooth by a land, the distance between adjacent teeth being uniform and substantially equal.

24. The apparatus of claim 17 wherein the magnet generates a magnetic field, and the sensor further comprises a ferritic core, and the coil is wound around the core.

25. The apparatus of claim 17, wherein the variation in reluctance of the flux path has a frequency representative of the rotational speed of the target component.

26. The apparatus of claim 17 wherein the magnet generates a magnetic field; and

the sensor further comprises a ferritic core, and an inductive coil wound around the core, and wherein said signal is a voltage signal induced in the coil in response to rotation of the target component in said magnetic field.

27. The apparatus of claim 17 wherein the second component is of stainless steel formed by stamping at a temperature greater than 32 degrees F.

28. The apparatus of claim 17 wherein the second component is of stainless steel having an instability factor that is less than 2.9 percent, and is formed by stamping at a temperature greater than 32 degrees F.

29. The apparatus of claim 17 wherein the second component is of stainless steel having a concentration of martensite that is less than 15 percent, and is formed by stamping at a temperature greater than 50 degrees F.

30. The apparatus of claim 17 wherein the second component is of stainless steel having an instability factor that is less than 1.0 percent, and is formed by stamping at a temperature greater than 50 degrees F.

31. A method for producing an assembly, comprising the steps of:

forming a case substantially fixed against rotation and adapted to contain transmission components;

installing a target component supported for rotation in the case;

forming a second component having at least a portion thereof formed of material having a relative magnetic permeability equal to or less than 25.0;

installing the second component in the case such that said portion thereof at least partially surrounds the target component; and

mounting a sensor on the case near the target component and second component, said portion of the second component being located between the sensor and target, the sensor including a coil and a magnet generating a flux path extending through said portion of the second component to said target component.

32. The method of claim 31, wherein the step of forming a second component further comprises the steps of:

determining a concentration of martensite in the material of said portion that would permit generation by the sensor of a signal having a predetermined pear-to-peak amplitude; and

determining an acceptable temperature at which the metal can be formed by stamping without exceeding the acceptable concentration of martensite after stamping;

determining the chemical composition of the chemical components of the metal from which the second component may be formed;

determining the concentration of martensite present in the metal using the chemical composition;

comparing the concentration of martensite to the acceptable concentration; and

if the concentration of martensite is less than the acceptable concentration, then stamping the second component at a temperature that is equal to or greater than the acceptable temperature.

33. The method of claim 32, further comprising the step of:
installing the second component in the assembly.

34. The method of claim 32, wherein the step of determining the concentration of martensite further comprises:

determining the concentration by weight of martensite present in the metal using the chemical composition;

calculating the instability factor I(f)of the metal from the following relationship I(f) = (37.19) - 51.25(%C) - 2.59(%Ni) - 1.02(%Mn) - 0.47(% Cr) - 34.4(%N); and

determining the concentration of martensite from the magnitude of the instability factor.

35. The method of claim 32, wherein the step of determining the concentration of martensite further comprises:

determining the concentration by weight of martensite present in the metal using the chemical composition;

calculating the martensite deformation MD(30) of the metal from the following relationship MD(30) = (413) - 462(C+N) - 9.2(Si) - 8.1(Mn) - 13.7(Cr) - 9.5(Ni) - 18.5(Mo); and

determining the concentration of martensite from the magnitude of martensite deformation.

36. The method of claim 32, further comprising the step of:

using a ferrite scope to measure the concentration of martensite in the second component; and

installing the second component in the assembly, if the ferrite scope indicates the concentration of martensite is equal to or less than the acceptable concentration.

37. A method for determining a rotational speed of a target component, the target component being at least partially surrounded by the second component, the method comprising the steps of:

generating a magnetic flux path that substantially passes through the second component and extends to the target component, rotation of the target component causing changes in a characteristic of the magnetic flux path;

generating a position signal that varies in response to changes in said characteristic; and

determining a rotational speed of the target component based on values of said position signal over time.